

# SDMS US EPA REGION V

## FORMAT- OVERSIZED - 5

### IMAGERY INSERT FORM

The item(s) listed below are not available in SDMS. In order to view original document or document pages, contact the Superfund Records Center.

<b>SITE NAME</b>	<b>Waukegan Tar Pit</b>		
<b>DOC ID #</b>	<b>133533</b>		
<b>DESCRIPTION OF ITEM(S)</b>	<b>Map - Figure 1 - Existing an Proposed Boring and Well Locations</b>		
<b>REASON WHY UNSCANNABLE</b>	<u>  X  </u> <b>OVERSIZED</b>	<b>OR</b>	<u>      </u> <b>FORMAT</b>
<b>DATE OF ITEM(S)</b>	<b>none</b>		
<b>NO. OF ITEMS</b>	<b>1</b>		
<b>PHASE</b>	<b>E.1 - E.5</b>		
<b>PRP</b>	<b>Waukegan Tar Pit</b>		
<b>PHASE</b> (AR DOCUMENTS ONLY)	<u>      </u> Remedial <u>      </u> Removal <u>      </u> Deletion Docket <u>      </u> AR <u>      </u> Original <u>      </u> Update # <u>      </u> Volume <u>      </u> of <u>      </u>		
<b>O.U.</b>			
<b>LOCATION</b>	Box # <u>  1  </u> Folder # <u>  1  </u> Subsection <u>  E  </u>		
<b>COMMENT(S)</b>			

***Supplemental Extent of  
Contamination Study  
Work Plan (WP2)***

***Waukegan Tar Pit Site  
Waukegan, Illinois***

***February 1992***

***Supplemental Extent of  
Contamination Study  
Work Plan (WP2)***

***Waukegan Tar Pit Site  
Waukegan, Illinois***

***February 1992***

***Barr***

*Engineering Company  
8300 Norman Center Drive  
Minneapolis, MN 55437  
Phone: (612) 832-2600  
Fax: (612) 835-0186*

SUPPLEMENTAL EXTENT OF CONTAMINATION STUDY  
WORK PLAN (WP 2)  
WAUKEGAN TAR PIT SITE

Table of Contents

	<u>Page</u>
1. Purpose and Scope of Investigation . . . . .	1
2. Number and Location of Soil Borings and Wells . . . . .	1
3. Drilling and Sampling Methodology . . . . .	2
4. Drilling and Sampling Equipment Decontamination Procedures . . . . .	3
5. Monitoring Well Installation . . . . .	4
6. Soil Sample Analysis . . . . .	4
7. Groundwater Sampling and Analysis . . . . .	5
8. Supplemental Extent of Contamination Study Report . . . . .	5

List of Tables

TABLE 1	Rationale for Selection of Soil Boring Locations
TABLE 2	Soil and Groundwater Sample Analytical Parameters

List of Figures

FIGURE 1	Existing and Proposed Boring and Well Locations
----------	---

List of Appendices

APPENDIX A	Technical Specifications for Soil Borings and Monitoring Wells
------------	--

SUPPLEMENTAL EXTENT OF CONTAMINATION STUDY  
WORK PLAN (WP 2)  
WAUKEGAN TAR PIT SITE

1. Purpose and Scope of Investigation

This investigation is being performed in response to the requirements of the September 4, 1991 unilateral Administrative Order, Docket No. V-W-91-C-115, in the matter of Waukegan Tar Pit Site. The purpose of the investigation is to more accurately define the "extent of contamination of the tar, as defined in Paragraph 5 of the determinations section, from the tar pit to the surrounding property, including soil and groundwater media" (Administrative Order). The Supplemental Extent of Contamination Study will necessitate the installation of additional soil borings, soil sampling, and soil analyses. In order to determine the extent of contamination in the groundwater, monitoring wells will be installed and groundwater samples will be collected and analyzed.

2. Number and Location of Soil Borings and Wells

Approximately fifteen (15) soil borings will be advanced to the top of the gray "hardpan" till (depth of approximately 30 feet) for purposes of collecting soil samples to further evaluate the extent of contamination of the tar. Two additional borings (B-38 and B-39) were performed in January 1992, immediately after the removal of tar from the former tar pit. The approximate locations of the existing and proposed soil borings are shown on Figure 1. The boring locations were selected to provide borings to show the limits of visible extent of contamination from the tar pit. The proposed soil borings are identified as soil borings B-37 through B-53. The rationale for the selection of the soil boring locations is listed in Table 1. The actual locations of the proposed soil borings will depend upon access and utility locations. Drilling of Soil Borings B-45 and B-46 will be coordinated with Commonwealth Edison in order to temporarily shut off power

in overhead power lines adjacent to the proposed locations for soil borings B-45 and B-46.

During placement of the borings, visual observation of the soil samples will be used to determine the need for additional borings for purposes of further delineating the extent of contamination of the tar.

Four monitoring wells are proposed. The approximate locations of the monitoring wells are shown on Figure 1. Actual locations will depend upon access and utility locations.

Monitoring well installation is intended to fulfill Paragraph 5 of the Order section, which states that the Respondents shall accurately determine the extent of contamination of the tar, "including soil and groundwater media." Four monitoring wells are proposed because the direction of groundwater flow in this area is not defined. The monitoring wells are located to provide measuring points for determining groundwater flow directions and with the intent to provide groundwater sampling locations that will be upgradient, downgradient, and lateral with respect to groundwater flow past the tar pit, no matter which direction groundwater is found to be flowing, or if flow directions change. The proposed monitoring wells are approximately equally spaced around the former tar pit.

### 3. Drilling and Sampling Methodology

Soil borings and boreholes for wells will be advanced using 3.25-inch I.D. hollow-stem auger drilling methods. Where hollow-stem auger refusal is encountered the borehole will be advanced past the obstruction using tricone rotary drilling methods to drill through the obstruction. Where heaving soil conditions are encountered, the borehole will be flushed to the bottom of the auger using tricone rotary drilling methods and water to flush the borehole. The location and ground-surface elevation at each soil boring will be surveyed.

Soil samples will be collected continuously from soil borings using 2-foot long split-spoon samplers in accordance with ASTM Method D-1586, "Standard Method for Penetration Test and Split-Barrel Sampling of Soils." Split-spoon samplers will be fitted with a brass liner. Soil samples will be screened in the field with a photo-ionization detector (PID) using the head-space method described in the QA/QC Plan. Soil samples will be described using ASTM Method D-2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" with particular attention paid to the presence of tar or tar-like materials. Samples will be retained in threaded glass jars with teflon septum lids for analyses and/or further identification.

Split-spoon samplers will be cleaned in trisodium phosphate solution and double rinsed in potable water before collection of each sample. Wash and rinse waters will be changed, as needed, to ensure that the samplers are free of tar and tar-like materials. Previous experience at the site indicates that adhesion of tar or tar-like material to the sampling devices and other downhole tools is not likely to occur. Should tar or tar-like material adhere to the samplers after washing, clean samplers will be substituted.

#### 4. Drilling and Sampling Equipment Decontamination Procedures

Augers, drill stem, downhole tools, samplers, and the back of the drill rig will be steam cleaned prior to commencing work at the site. All augers, downhole tools, drill stem, samplers, and equipment used will be steam cleaned before beginning each new borehole. Tar or tar-like material clinging to the augers or tools will be removed from the equipment or clean equipment will be substituted. If necessary, a solvent will be used prior to steam cleaning to remove tar material. Previous experience at the site indicates that tar material may adhere to the auger surface but does not adhere to split-spoon samplers or other downhole equipment. If material cannot be removed from the split-spoon sampler or other downhole equipment by a combination of steam cleaning, TSP solution, and/or scraping, unused downhole equipment will be used to replace the contaminated equipment before

proceeding. Decontamination fluids will be containerized and transported off-site.

#### 5. Monitoring Well Installation

Monitoring Wells will be constructed of 10-foot long, 2-inch nominal diameter stainless steel screens and 2-inch nominal diameter stainless steel riser pipe. Well material will be new and will be steam cleaned prior to installation. Screen and casing will be installed in boreholes advanced by 6.25-I.D. hollow-stem auger. A sand pack will be placed in the annulus around the screened portion of the well and the remainder of the annulus will be grouted with neat cement grout. Outer steel well casing, equipped with locking well cap, will be flush-mounted at the ground surface. Three steel protective posts will be installed around each monitoring well. Well construction details are in the attached Technical Specifications.

The top of the screen will be set approximately 1 to 3 feet below the ground surface so that the water table will intersect near the top of the screen. Wells will be developed by a combination of pumping and surging.

The location, ground-surface elevation, and riser-pipe elevation at each well will be surveyed.

#### 6. Soil Sample Analysis

All soil samples will be described in the field and screened by the head-space method, using a PID device. All samples collected in the field will be placed in threaded glass jars with teflon-septum lids so as to render any soil sample collected available for chemical analyses, should the need arise.

The results of the headspace screening and visual observation of the soil samples collected during the installation of the soil borings will be used to determine which samples to send to the laboratory for analysis. Soil samples will be considered "clean" if no visible tar or tar-like material is



noted in the sample. If this condition is not satisfied, the sample will not be considered a "clean" soil sample during field screening.

Six to eight soil samples thought to be "clean" based on the field screening will be sent to the laboratory for analysis. Three to five soil samples that appear to contain tar-like material, if such material is found in the borings, will also be sent to the laboratory for analysis. In boreholes which would be considered "clean" by the field screening, one sample will be selected and analyzed. The soil samples will be analyzed for the volatile and semivolatile organic compounds shown in Table 2.

#### 7. Groundwater Sampling and Analysis

The groundwater elevation will be measured in each monitoring well prior to pumping and sampling. Groundwater samples will be collected from each of the monitoring wells once each quarter for three quarters. The sample collection and handling procedures are described in the QA/QC plan. The groundwater samples will be analyzed for the volatile and semivolatile organic compounds shown in Table 2.

#### 8. Supplemental Extent of Contamination Study Report

At the completion of the tasks described in this Work Plan, a report will be prepared and submitted to the U.S Environmental Protection Agency. In addition to presenting the results of this investigation, the report will correlate the results of this study, including borings B-38 and B-39, with those of the previous investigation. Submission of this report will complete the requirements of the Administrative Order.

The report will include logs of soil borings, logs of well construction, a figure showing the locations of borings and wells, cross sections to include geologic information of proposed borings, results of groundwater and soil screening and analyses, and piezometric maps of water table showing inferred groundwater flow directions.

## ***Tables***

TABLE 1  
RATIONALE FOR SELECTION OF SOIL BORING LOCATIONS

<u>Proposed Soil Boring</u>	<u>Rationale</u>
B-37	Located northwest of B-29. Soil boring B-37 is located to further delineate the extent of tar southwest of the former tar pit. Boring B-29 contained stringers of tar material at depths from 6 to 18 feet. Boring B-26 contained tar-like material mixed with soil at depths from 6 to 11 feet. Absence of tar in B-37 will provide delineation of the extent of tar southwest of the former tar pit.
B-38	Located in the northern portion of the former tar pit. The purpose of B-38 is to evaluate the soils underneath the excavated former tar pit. Soil boring B-38 was performed in January 1992.
B-39	Located in the southern portion of the former tar pit. The purpose of B-39 is to evaluate the soils underneath the excavated former tar pit. Soil boring B-39 was performed in January 1992.
B-40	Located west of B-25, north of B-26 and southwest of B-24. Boring B-40 is located to further delineate the extent of tar west of the former tar pit. Boring B-25 contained tar-like material mixed with soil from 8 to 11 feet and stringers of tar to 20 feet. Boring B-26 contained tar-like material mixed with soil at depths from 6 to 11 feet. Boring B-24 did not contain tar material. Absence of tar in B-40 will provide delineation of tar west of the former tar pit.
B-41	Located west of B-23, northwest of B-24, and southwest of B-7. Boring B-41 is located to further delineate the extent of tar northwest of the former tar pit. Borings B-7 and B-24 did not contain tar. Boring B-23 contained zones of tar-like material mixed with soil from the ground surface to a depth of approximately 11 feet. Absence of tar in B-41 will provide delineation of tar northwest of the former tar pit.
B-42	Located along the north fence line, west of B-20. Boring B-42 is located to further delineate the extent of tar north-northwest of the former tar pit. Boring B-20 contained stringers of tar from 0 to 4 feet. Absence of tar in B-42 will provide delineation of tar north-northwest of the former tar pit.

TABLE 1 (continued)  
RATIONALE FOR SELECTION OF SOIL BORING LOCATIONS

<u>Proposed Soil Boring</u>	<u>Rationale</u>
B-43	Located along the north fence line near the junction with the east fence line. Boring B-43 is located to further delineate the extent of tar northeast of the former tar pit. Boring B-43 will be located east of Boring B-17. Boring B-17 contained sand with tar from 5 to 7 feet and a thin stringer of tar-like material at approximately 10 feet. Boring B-43 is located to verify that the tar-like material is absent or very thin northeast of the former tar pit.
B-44	Located north of the center of the former tar pit. Boring B-44 is located to characterize the shallow soils and investigate the till interface immediately north of the former tar pit. No borings have previously been located in this immediate vicinity.
B-45	Located along the fence line east of the former tar pit, and north of B-15. Boring B-45 is located to further delineate the extent of tar east of the tar pit. Boring B-15 did not contain visible tar but was advanced only to a depth of 1 foot.
B-46	Located along the fence line east of the former tar pit, south of B-15, and north of B-16. Boring B-46 is located to further delineate the extent of tar east and southeast of the former tar pit. Boring B-15 did not contain visible tar but was advanced only to a depth of 1-foot. Boring B-16 did contain some tar at a depth of 1.2 feet.
B-47	Located in the Dahringer Road right-of-way, north of the north fence line and northeast of boring B-20. Boring B-47 is located to further delineate the northern extent of tar and to verify whether or not tar is beyond the fenced-in portion of the site. Boring B-20 contained stringers of tar from 0 to 4 feet.
B-48	Located in the Dahringer Road right-of-way, north of boring B-17. Boring B-48 is located to further delineate the northern extent of tar and to verify whether or not tar is beyond the fenced-in portion of the site. Boring B-17 contained sand with tar from 5 to 7 feet and a thin stringer of tar at approximately 10 feet.

TABLE 1 (continued)  
RATIONALE FOR SELECTION OF SOIL BORING LOCATIONS

<u>Proposed Soil Boring</u>	<u>Rationale</u>
B-49	Located in the Dahringer Road right-of-way, north of boring B-43. Boring B-49 is located to further delineate the northeastern extent of tar and to verify whether or not tar is beyond the fenced-in portion of the site. If no tar is observed at Boring B-43, Boring B-49 may be deleted.
B-50	Located east of the EJ&E Railway and northeast of the former tar pit. Boring B-50 is located to further delineate the northeastern extent of tar and to verify whether or not tar is east of the site, beyond the railroad tracks.
B-51	Located east of the EJ&E Railway and east of the former tar pit. Boring B-51 is located to further delineate the northeastern extent of tar and to verify whether or not tar is east of the site, beyond the railroad tracks. The proposed location of Boring B-51 is east of Boring B-15, which did not contain visible tar but was only advanced to a depth of 1 foot.
B-52	Located east of the EJ&E Railway and southeast of the former tar pit. Boring B-52 is located to further delineate the eastern extent of tar and to verify whether or not tar is east of the site, beyond the railroad tracks.
B-53	Located east of B-34 and B-35, and south of B-31. Soil Boring B-53 is located to further delineate the southern and eastern extent of tar material in the soil, particularly in the area east of B-35. Boring B-31 contained some tar and soil containing tar at depths of 2 to 9 feet. Boring B-34 contained tar and soil containing tar at depths of 8 to 10 feet. Boring B-35 did not contain tar material. Absence of tar in B-53 will complete the delineation of the southern boundary of tar material.

TABLE 2

## SOIL AND GROUNDWATER SAMPLE ANALYTICAL PARAMETERS

Volatile Organic Compounds

Benzene	Methylene Chloride
Toluene	Acetone
Ethylbenzene	2-Butanone
Xylenes, total	Styrene

Semivolatile Organic Compounds

2,3-Benzofuran  
 2,3-Dihydro-1H-Indene  
 1H-Indene  
 Naphthalene  
 Benzo(b)thiophene  
 Isoquinoline  
 2-Methylnaphthalene  
 Indole  
 1-Methylnaphthalene  
 Biphenyl  
 Acenaphthalene  
 Acenaphthene  
 Dibenzofuran  
 Fluorene  
 Dibenzothiophene  
 Phenanthrene  
 Anthracene  
 Acridine  
 Phenanthridine  
 Carbazole  
 Fluoranthene  
 Pyrene  
 Triphenylene  
 Benzo(g,h,i)perylene  
 7,12-Dimethylbenzene(a)anthracene  
 Benzo(e)pyrene  
 Perylene  
 3-Methylcholanthrene  
 Quinoline  
 Benzo(a)anthracene<sup>1</sup>  
 Chrysene<sup>1</sup>  
 Benzo(b)fluoranthene<sup>1</sup>  
 Benzo(a)pyrene<sup>1</sup>  
 Indeno(1,2,3-cd)pyrene<sup>1</sup>  
 Dibenz(a,h)anthracene<sup>1</sup>  
 Benzo(k)fluoranthene<sup>1</sup>

---

<sup>1</sup>Carcinogenic PAH compound

## ***Figures***

## ***Appendix A***

### ***Technical Specifications for Soil Borings and Monitoring Wells***



EXHIBIT C  
TECHNICAL SPECIFICATIONS

SECTION C-1

SPECIFICATION FOR MOBILIZATION AND DEMOBILIZATION

BARR'S Project Number: 13/49-004JSL01  
BARR'S Project Title: Waukegan Tar Pits  
BARR'S Project Manager: James Langseth

1.1 SCOPE

The work covered by this section of the Specifications consists of but is not limited to furnishing all labor, equipment, and materials and performing all operations necessary to move personnel, equipment, supplies, and incidentals to the project site, to perform all work that must be performed before beginning work on the various items for which payment is provided elsewhere in these Specifications, to obtain all permits required to perform the work, and to furnish all bonds and any insurance obtained specifically for this project, all in accordance with the Agreement and Exhibit A. In addition, the work covered by this section includes removing all equipment from the project site after it is no longer needed and restoring the project site to the specified condition.

1.2 PERFORMANCE

1.2.1 Equipment Preparation

The drill rig shall be cleaned with a high-pressure water jet, and all tools that enter the borehole, including but not limited to hollow stem auger, drill bits, drill rods, bailers, casing and pipe, shall be cleaned with steam or a high-pressure hot-water jet sufficient to remove all oil, grease and other objectionable

material. Water used for cleaning shall be potable water and free of additives such as antifreeze. No joint dressing or other compound shall be used on down-hole equipment.

#### 1.2.2 Site Requirements

The DRILLING CONTRACTOR shall decontaminate equipment in an area designated by BARR. Chemicals used to remove tar residue from the DRILLING CONTRACTOR's equipment and wastes generated during removal of tar residue shall be containerized. The DRILLING CONTRACTOR shall be responsible for containerization, transport off-site, and disposal of this material in compliance with applicable local, state, and federal regulations.

The DRILLING CONTRACTOR shall containerize contaminated drill cuttings, as determined by BARR, in Department of Transportation approved 17-H drums, seal and label the drums, and transport the drums to an on-site location designated by BARR for later disposal by BARR or BARR's Client.

### 1.3 MEASUREMENT AND PAYMENT

- 1.3.1 The DRILLING CONTRACTOR will receive payment for mobilization on the basis of a lump sum price. Prior to the first partial payment application, the DRILLING CONTRACTOR shall submit a schedule of values acceptable to BARR for the costs included in the lump sum price for mobilization. Included in mobilization shall be the DRILLING CONTRACTOR's costs for permits and fees, bonds and premiums for any special insurance obtained for this project, equipment mobilization, restoration, and all other items not specifically paid for but included in the total scope of the Work.

- 1.3.2 Containerizing decontamination wastes shall be measured for payment by the drum. Payment will be by the unit price per drum and will include full compensation for all equipment, materials, drums, and labor required to containerize decontamination wastes, transport the drums off-site, and properly dispose of the drummed waste.
- 1.3.3 Containerizing drill cuttings shall be measured for payment by the drum. Payment will be by the unit price per drum and will include full compensation for all equipment, materials, drums, and labor required to containerize drill cuttings and transport the drums to the designated on-site location.

EXHIBIT C  
TECHNICAL SPECIFICATIONS

SECTION C-2  
SPECIFICATIONS FOR BORINGS

2.1 SCOPE

The work covered under this section of the Specifications consists of furnishing all labor, materials, equipment, and performing all operations necessary to conduct standard penetration tests and obtain and preserve soil samples by drive sampling and auger sampling. Also included are maintenance cleaning of equipment between borings, protection of borings, and backfilling borings. The location of the site is shown in the Contract Drawings (Exhibit B).

2.1.1 Boring Requirements

Ten borings are planned to determine the soil type, depth to groundwater, and to obtain soil samples for chemical analysis. Samples shall be taken continuously from the ground surface to approximately 30 feet below ground surface. The DRILLING CONTRACTOR shall stop drilling as directed to wait for the water level in the borings to stabilize.

2.2 REFERENCE STANDARDS

2.2.1.1 ASTM D-1586 Standard Methods for Penetration Test and Split-Barrel Sampling of Soils

2.2.1.2 ASTM D-1452 Standard Practice for Soil Investigation and Soil Sampling by Auger Borings

#### 2.2.1.3 ASTM C-150 Specifications for Portland Cement

In case of conflict between these Technical Specifications and the above standards, the Technical Specifications will prevail.

### 2.3 MATERIALS

#### 2.3.1 Drilling Fluid

In order to prevent heaving of saturated sand into the hollow stem auger, the DRILLING CONTRACTOR may fill the auger with drilling fluid. Drilling fluid shall be potable water defined as water which is safe for human consumption in that it is free from impurities in amounts sufficient to cause disease or harmful physiological effects.

In the event that mud rotary drilling methods must be used, the drilling fluid shall be composed of potable water with the minimum amount of bentonite necessary to stabilize the borehole.

#### 2.3.2 Portland Cement

Portland Cement shall have high early strength (Type III) and shall meet the requirements of ASTM C-150.

#### 2.3.3 Bentonite

Bentonite shall be finely ground, premium grade, bentonite equal to Aquagel Gold Seal manufactured by NL Baroid Industries, Inc. of Houston, Texas. The bentonite shall be free from lumps and objectionable material that would prevent easy mixing into a smooth fluid free from lumps of unmixed bentonite.

#### 2.3.4 Bentonite Grout

The bentonite grout shall consist of a mixture of one bag (94 pounds) of bentonite to not more than 6 gallons of potable water. No other admixtures will be allowed.

### 2.4 PERFORMANCE

The DRILLING CONTRACTOR shall practice good drilling procedure that conforms with ASTM or other procedures specified in these Contract Documents. If, in the opinion of BARR, the DRILLING CONTRACTOR's procedure is inadequate to obtain samples of the quality specified, the DRILLING CONTRACTOR shall change procedures to meet the requirements of these specifications.

#### 2.4.1 Maintenance Cleaning/Decontamination

All equipment and tools used on a boring shall be steam cleaned after completing the boring and before setting up on the next boring.

Disposal of fluids and cleaning materials other than steam used to decontaminate equipment and tools shall be according to specific site requirements in Section 1.2.2.

#### 2.4.2 Boring Location

The general locations of the borings are shown on the Contract Drawings (Exhibit B). The locations will be staked in the field by BARR. The final locations shall be determined according to ARTICLES 4 and 5 of the AGREEMENT.

#### 2.4.3 Borehole Advancement

The borehole shall be advanced using a hollow stem auger with a minimum inside diameter of 3-1/4-inches. In the event that a borehole cannot be completed with hollow-stem auger due to heaving sand or other subsurface conditions as determined by BARR, the following method may be used.

The upper part of the borehole shall be stabilized with hollow-stem auger or steel casing. The borehole below the casing shall be advanced using mud rotary drilling methods that allow split barrel sampling as described in Section 2.4.7.

#### 2.4.4 Care and Maintenance of Borings

During the course of drilling, the DRILLING CONTRACTOR shall be responsible for the care and maintenance of the borings and shall maintain the site in such condition and protect the borings in such manner that no undesirable materials are spilled, dripped, or introduced into a boring by any means.

#### 2.4.5 Boring Abandonment

If for any reason a borehole cannot be completed, the DRILLING CONTRACTOR shall contact BARR for permission to abandon the boring. The DRILLING CONTRACTOR shall not abandon any boring without being directed to do so. Boring abandonment includes removing all augers, casing and/or tools from the boring and sealing the hole according to paragraph 2.4.6 Backfilling Boreholes.

#### 2.4.6 Backfilling Boreholes

The DRILLING CONTRACTOR shall backfill all borings with bentonite grout tremied from the bottom of the boring so as to displace all water, drilling fluid, and drill cuttings. If settling occurs, additional grout shall be added to backfill the borehole to the surrounding grade.

#### 2.4.7 Directed Nondrilling Time

The DRILLING CONTRACTOR shall at BARR's direction stop the drilling process and remain at the site in a status of Directed Nondrilling Time.

Directed Nondrilling Time is that time the DRILLING CONTRACTOR is directed by BARR to stop the drilling process and assist BARR's representative in collecting a water sample, perform a recharge test or other task related to obtaining information from the boring, or simply remain at the site ready to work. A specific example of Directed Nondrilling Time is when BARR directs the DRILLING CONTRACTOR to bail the borehole and wait for the water level to stabilize. Directed Nondrilling Time does not include time the DRILLING CONTRACTOR is ordered by BARR to stop drilling because of noncompliance with the terms of this Contract.

#### 2.4.8 Sample Requirements

Standard penetration tests and split-barrel sampling shall be performed according to ASTM D-1586 Standard Methods for Penetration Test and Split-Barrel Sampling of Soils. Split-barrel samplers shall be fitted with brass liners. The split-



barrel sampler with drive shoe shall be of sufficient length to allow routine sample drives of 24 inches.

Upon recovery of a sample, BARR will inspect the sample, and the DRILLING CONTRACTOR shall place it in a new, airtight glass jar provided by the DRILLING CONTRACTOR. Samples for chemical analysis may also be obtained by BARR in sample containers provided by BARR.

The sampler shall be washed with a solution of trisodium phosphate (TSP) and potable water, rinsed twice with potable water, and wiped dry prior to reuse after taking a sample. The DRILLING CONTRACTOR shall change the TSP wash water and the rinse water as directed by BARR.

## 2.5 MEASUREMENT AND PAYMENT

Payment for all materials, equipment, supplies and labor necessary to perform the work requested under the terms of this Contract will be made according to EXHIBIT D, SCHEDULE OF UNIT PRICES. All functions not specifically covered by a pay item will be considered incidental to the work performed. Payment will be made only for those items ordered or approved by BARR and meeting the contract requirements.

### 2.5.1 Maintenance Cleaning

Payment for cleaning equipment and tools between borings will be measured for payment by the boring except that cleaning for the first boring will be considered paid in Mobilization and will not be counted for payment. Payment will be at the unit price per boring and will constitute full compensation for all labor, equipment, and materials required to clean the equipment. Only

one cleaning per boring will be counted regardless of the number of times cleaning is performed for a boring.

2.5.2 Set Up On a Boring

Set up on a boring will be measured for payment by the boring. Payment will be at the unit price per boring and will constitute full compensation for all labor, equipment and materials required to move the drill rig and other equipment between borings and set up at a boring location in preparation for drilling. Only one set up will be paid per boring regardless of the number of times and for whatever reasons the equipment is moved to and set up at a boring location.

2.5.3 Boring Abandonment

Boring abandonment directed by BARR will be paid as described under 2.5.6 Backfilling Boreholes. No payment will be made for work performed to abandon a boring or for an equivalent replacement boring when abandonment is necessary because of some fault of the DRILLING CONTRACTOR's personnel, equipment, procedure, materials, or for borings abandoned without specific direction by BARR to do so. Work performed and accepted by BARR prior to abandonment will be counted for payment.

2.5.4 Borehole Advancement by Hollow Stem Auger

Borehole advancement by hollow stem auger will be measured for payment to the nearest foot from the ground surface to the bottom of the auger. Payment will be by the unit price per foot and will constitute full compensation for all labor, equipment, and materials required to set and remove the auger.

#### 2.5.5 Borehole Advancement By Rotary Drilling

Borehole advancement by rotary drilling will be measured for payment to the nearest foot from the depth in the hole that the rotary drilling starts to the bottom of the rotary-drilled hole. Payment will be by the unit price per foot and will constitute full compensation for all labor, equipment and materials required to advance the hole, stabilize the hole with drilling fluid or temporary casing, and remove the drilling tools.

#### 2.5.6 Backfilling Boreholes

Backfilling boreholes will be measured for payment by the bag (50 pound) of bentonite used to grout boreholes. Payment will be by the unit price per bag of bentonite and will constitute full payment for all materials, labor and equipment required to seal the borehole. Only those holes identified by BARR to be grouted will be paid for by this payment item. No payment will be made for holes backfilled with any materials other than bentonite.

#### 2.5.7 Personal Protection

Personal protection will be measured for payment by the hour each person wears protective clothing and/or equipment. Payment will be by the unit price per hour for the levels of protection listed in EXHIBIT D and will include full compensation for providing all clothing, respirators, masks, air tanks, monitoring equipment, decontamination, and cleaning or disposal of contaminated equipment and clothing, and all other expenses incurred with providing personal protection.

2.5.8 Directed Nondrilling Time

Directed nondrilling time will be measured for payment by to the nearest 1/4 hour. Payment will be by the unit price per hour and will include full compensation for all labor and equipment either used or idle. No payment will be made for nondrilling time not specifically directed by BARR, time when the DRILLING CONTRACTOR is not at the site ready to work, or when drilling is ordered stopped for noncompliance with the terms of this Contract.

2.5.9 Standard Penetration Test and Split-Barrel Sampling of Soils

Standard penetration tests and split-barrel sampling will be measured for payment by the penetration test (24-inch drive) in which sample recovery is adequate to allow reliable classification of the soils and meets minimum requirements for testing. Short recoveries will be counted for payment when, in the judgment of BARR, the short sample is due to no fault of the DRILLING CONTRACTOR's procedure or equipment. Payment will be by the unit price per sample and will constitute full compensation for all labor, equipment, and materials required to obtain an acceptable sample.

EXHIBIT C  
TECHNICAL SPECIFICATIONS

SECTION C-3  
SPECIFICATIONS FOR 2-INCH MONITORING WELLS

3.1 SCOPE

The work covered under this section includes furnishing all labor, equipment and materials and performing all operations necessary to collect soil samples, prepare well logs and a letter report, clean equipment between wells, and construct 2-inch inside diameter monitoring wells using minimum 6-1/4-inch inside diameter hollow-stem auger. The location of the site is shown in the Contract Drawings (Exhibit B).

3.1.1 Monitoring Well Description

The monitoring wells will be 2-inch diameter stainless steel, with 5-foot long screens. The wells will be screened across the water table which is anticipated to be approximately three feet below the ground surface.

3.2 REFERENCE STANDARDS

3.2.1 ASTM D-1586 Standard Method for Standard Penetration Test and Split-Barrel Sampling

3.2.2 ASTM C-150 Specifications for Portland Cement

In case of conflict between these Technical Specifications and the above standards, the Technical Specifications will prevail.

### 3.3 MATERIALS

#### 3.3.1 Drilling Fluid

Drilling fluid shall be potable water defined as water which is safe for human consumption in that it is free from impurities in amounts sufficient to cause disease or harmful physiological effects. No additives shall be used.

#### 3.3.2 Well Screen

The well screen shall be 10-foot long stainless steel type 304 or 305, 2-inch diameter, pipe size, continuous No. 10 slot with length designated in 3.1.1 and fitted with a flat base plate and threaded female flush coupling welded to the screen. The inside diameter shall not be less than 1.75 inches throughout the full length of the assembly including the attached coupling. Well screens not cleaned and protected by the manufacturer shall be steam cleaned. Screen, ends, and fittings shall subsequently be covered by aluminum foil (shiny side out) and then covered and protected by a more durable material for storage and transportation to the site. Well screen shall be steam cleaned on-site prior to installation.

#### 3.3.3 Sand Pack

The sand pack shall consist of a clean, durable, uniformly graded natural sand meeting the specifications of the 35-40 sand produced by American Materials Corporation, Eau Claire, Wisconsin.

#### 3.3.4 Riser Pipe and Fitting

The riser pipe shall be new, 2-inch inside-diameter, Schedule 5 stainless steel type 304 or 305. Pipe fittings shall be flush male and female threads and of the same grade stainless steel as the riser pipe. Riser pipe not cleaned and protected by the manufacturer shall be steam cleaned. Ends and fittings shall subsequently be covered by aluminum foil (shiny side out) and then covered and protected by a more durable material for storage and transportation to the site. Riser pipe shall be steam cleaned on-site prior to installation.

#### 3.3.5 Riser Pipe Cap

The riser pipe cap shall be a plastic slip cap with a 1/8-inch vent hole drilled through the top.

#### 3.3.6 Portland Cement

Portland cement shall have high early strength (Type III) and shall meet the requirements of ASTM C 150.

#### 3.3.7 Bentonite

Bentonite shall be finely ground, premium grade, bentonite equal to Aquagel Gold Seal manufactured by NL Baroid Industries, Inc. of Houston, Texas. The bentonite shall be free from lumps and objectionable material that would prevent easy mixing into a smooth fluid free from lumps of unmixed bentonite.

3.3.8 Bentonite Pellets

Bentonite pellets shall consist of pelletized sodium montmorillonite furnished in sacks or buckets from a commercial source and free of impurities that adversely impact the water quality in the well.

3.3.9 Neat Cement Grout

The neat cement grout shall consist of a mixture of one bag (94 pounds) Portland cement to not more than 6 gallons of potable water. Bentonite up to 6 percent by weight of cement may be added. No other admixtures will be allowed.

3.3.10 Protective Casing and Cap

Protective casing shall be 4-inch diameter steel pipe (Schedule 40), finished with a loop for attachment to the protective casing cap. Protective casing cap shall be an overlapping steel cap of the same quality as the casing and finished with a hasp for attachment to the protective casing. The protective casing shall be flush mounted at the ground surface to ensure that no portion of the well screen is covered by the protective casing. A weephole in the protective casing shall be near the ground surface to allow drainage from around the well casing.

3.3.11 Protective Posts

Protective posts shall be 4-inch steel pipe (Schedule 40), 6 feet in length.



#### 3.3.12 Lock

A lock for each protective casing will be provided by BARR.

### 3.4 PERFORMANCE

#### 3.4.1 Maintenance Cleaning/Decontamination

All equipment or tools used on a well shall be steam cleaned after completing the well and before setting up on the next well.

Disposal of all fluids and cleaning equipment used to decontaminate equipment and tools shall be according to specific site requirements in Section 1.2.2.

#### 3.4.2 Monitoring Well Location

The general locations of the wells are shown on the Contract Drawings (Exhibit B). The locations will be staked in the field by BARR. The final locations shall be determined according to ARTICLES 4 and 5 of the AGREEMENT.

#### 3.4.3 Borehole Advancement

Well installation shall be by hollow-stem auger. The borehole shall be advanced to the design depth with 6-1/4-inch inside-diameter hollow-stem auger. A wash pipe shall be set to the bottom of the auger, and the auger flushed from the bottom with potable water until the return water is clear prior to setting the well.

The well screen and riser pipe, including an adequate number of centering guides, shall be assembled and installed so that the screen is at the design depth and the riser pipe extends 2 to 3 feet above ground surface. The riser pipe shall be finished so that the top is level and no rough edges exist.

The sand pack shall be installed, as the auger is pulled back, in a manner that will minimize segregation and ensure that the sand pack fills, as nearly as practicable, the annular space between the well screen and the borehole wall to a depth of 1 foot above the top of the screen. The auger shall be withdrawn in increments not to exceed 2 feet.

A bentonite pellet seal shall be placed above the sand pack. Bentonite pellets shall be poured in the annulus between the riser pipe and hollow stem auger to a depth of 2 feet above the top of the sand pack.

After the bentonite pellets are in place and the grout is mixed, approximately 5 gallons of potable water shall be poured down the annulus. Grout shall then be placed above the bentonite seal by pumping under pressure through a tremie pipe. After 6 inches of grout have been placed in the borehole, the discharge point of the tremie pipe shall be maintained at 3 inches or more below the grout surface. Full strength grout shall be placed to the ground surface. The hollow-stem auger shall be withdrawn as necessary during the grouting process.

#### 3.4.4 Sample Requirements

The soil shall be sampled according to the ASTM Designation D-1586, Penetration Test and Split-Barrel Sampling of Soils.

Samples shall be taken at intervals determined by BARR. If no sample is obtained from a sampling attempt, the hole shall be advanced 2 feet and a new sample taken. Upon recovery of a sample, BARR will inspect the sample and the DRILLING CONTRACTOR shall place it in a new, airtight glass jar provided by the Contractor. Samples for chemical analysis may be obtained by BARR in sample containers provided by BARR. The sampler shall be washed with a solution of trisodium phosphate (TSP) and potable water, rinsed twice with potable water, and wiped dry prior to reuse after taking a sample. The DRILLING CONTRACTOR shall change the TSP wash water and the rinse water as directed by BARR.

3.4.5 Well Alignment and Clearance

Wells shall be sufficiently plumb, straight, and free from restrictions to allow a bailer or pump 1.66 inches in diameter and 40 inches long to pass freely through the full length of the well. The DRILLING CONTRACTOR shall prove the alignment and clearance are adequate prior to acceptance by BARR.

3.4.6 Well Protection

The protective casing shall be installed to an approximate depth of 5 feet in the borehole. The exact depth shall be adjusted so that the top of the casing is even with the top of the capped riser pipe. The annulus between the protective casing and the borehole wall shall be filled with concrete grout from the ground surface to a depth of 5 feet. The grout surface outside the casing shall be sloped away from the casing. The annulus between the riser pipe and the protective casing shall be filled with grout to a level no more than 2 inches below the top of the riser pipe.

#### 3.4.7 Protective Posts

Three protective posts shall be placed 2 feet from the protective casing at equal distances from each other. The posts shall be set 2 feet into the ground in 12-inch diameter boreholes. The annulus between the boreholes and the posts and the inside of the posts shall be filled with concrete grout.

#### 3.4.8 Care and Maintenance of Wells

During the course of drilling, the DRILLING CONTRACTOR shall be responsible for the care and maintenance of the wells and shall maintain the site in such condition and protect the wells in such manner that no undesirable materials are spilled, dripped, or introduced into the well by any means.

#### 3.4.9 Well Abandonment

If for any reason a borehole or well cannot be completed, the DRILLING CONTRACTOR shall contact BARR for permission to abandon the well. The DRILLING CONTRACTOR shall not abandon any borehole or well without being directed to do so. Borehole and well abandonment includes removing all screens, casing and/or tools from the well, sealing the hole as nearly as possible for its full length with tremied cement grout and restoring the site.

### 3.5 MEASUREMENT AND PAYMENT

Payment for all materials, equipment, supplies and labor necessary to perform the work requested under the terms of this Contract will be made according to EXHIBIT D, SCHEDULE OF UNIT PRICES. All functions

not specifically covered by a pay item will be considered incidental to the work performed. Payment will be made only for those items ordered or approved by BARR and meeting the contract requirements.

3.5.1 Maintenance Cleaning/Decontamination

Payment for cleaning equipment and tools between wells will be measured by the well. Payment will be by the unit price per well and will constitute full compensation for all labor, equipment and materials required to clean the equipment. Only one cleaning per well will be counted regardless of the number of times cleaning is performed for a well.

3.5.2 Set Up on a Well

Set up on a well will be measured for payment by the well. Payment will be by the unit price per well and will constitute full compensation for all labor, equipment and materials required to move the drill rig and the equipment between wells and set up at a well site in preparation for drilling. Only one set up will be paid per well regardless of the number of times and for whatever reasons the equipment is moved to and set up at the well.

3.5.3 Well Abandonment

Well abandonment directed by BARR will be paid as described under 3.5.9 Furnish and Install Cement Grout. No payment will be made for work performed to abandon a well or for an equivalent replacement well when abandonment is necessary because of some fault of the DRILLING CONTRACTOR's personnel, equipment, procedure, materials, or for wells abandoned without specific direction by BARR to do so.

3.5.4 Borehole Advancement

Boreholes will be measured to the nearest foot from ground surface to the bottom of the borehole. Payment will be by the unit price per linear foot and will constitute full compensation for all labor, equipment, and materials required to advance the borehole.

3.5.5 Sampling

Sampling will be measured for payment by the penetration test in which sample recovery is adequate to allow reliable classification of the soils. Short recoveries will be counted for payment when, in the judgment of BARR, the short sample is due to no fault of the DRILLING CONTRACTOR's procedure or equipment. Payment will be by the unit price per sample and will constitute full compensation for all labor, equipment and materials required to conduct the penetration tests and retain samples.

3.5.6 Furnish and Install Well Screen

Well screen will be measured to the nearest foot. Payment will be by the unit price per foot of screen and will constitute full compensation for furnishing and installing the screen. Centering guides will be considered incidental to the screen.

3.5.7 Furnish and Install Riser Pipe

Riser pipe will be measured to the nearest foot. Payment will be by the unit price per foot of pipe and will constitute full compensation for furnishing and installing the pipe.

Couplings and centering guides will be considered incidental to the pipe.

3.5.8 Furnish and Install Sand Pack

The sand pack will be measured to the nearest bag (100 pounds) placed in the borehole. Payment will be by the unit price per bag and will constitute full compensation for furnishing and placing the sand pack.

3.5.9 Furnish and Install Bentonite Seal

The bentonite seal will be measured to the nearest bucket (50 pounds) placed in the borehole. Payment will be by the unit price per bucket and will constitute full compensation for furnishing and placing the bentonite seal.

3.5.10 Furnish and Install Cement Grout

Neat cement grout will be measured to the nearest bag (94 pounds) of cement and bentonite placed as specified. Payment will be by the unit price per bag of cement and bentonite and will constitute full compensation for furnishing, mixing and placing the grout.

3.5.11 Furnish and Install Protective Casing With Cap

Protective casing will be measured for payment by the 6-foot section installed as specified. Payment will be by the unit price per pipe section and will constitute full compensation for furnishing and installing the casing and furnishing one protective cap with each casing.

3.5.12 Furnish and Install Protective Posts

Protective post will be measured for payment by the post installed as specified. Payment will be by the unit price per post and will constitute full compensation for furnishing and installing the posts.

3.5.13 Personal Protection

Personal protection will be measured for payment by the hour each person wears protective clothing and/or equipment. Payment will be by the unit price per hour for the levels of protection listed in EXHIBIT D and will include full compensation for providing all clothing, respirators, masks, air tanks, monitoring equipment, decontamination, and cleaning or disposal of contaminated equipment and clothing, and all other expenses incurred with providing personal protection.

3.5.14 Directed Nondrilling Time

Directed nondrilling time will be measured for payment by to the nearest 1/4 hour. Payment will be by the unit price per hour and will include full compensation for all labor and equipment either used or idle. No payment will be made for nondrilling time not specifically directed by BARR, time when the DRILLING CONTRACTOR is not at the site ready to work, or when drilling is ordered stopped for noncompliance with the terms of this Contract.



